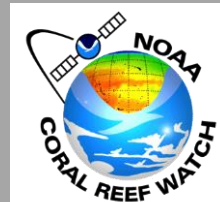


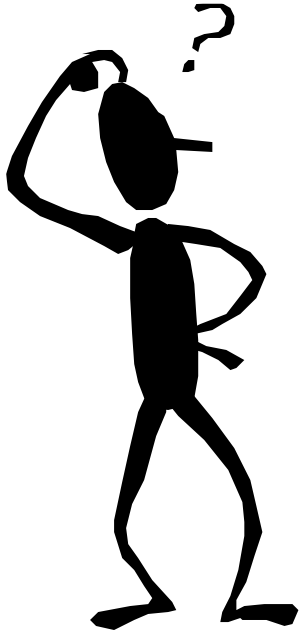
Beyond *Chasing Coral*: Bleaching Continues But You Can Make a Difference

Dr. C. Mark Eakin

Warner Memorial Presbyterian Church
retired from: NOAA Coral Reef Watch
<http://coralreefwatch.noaa.gov>

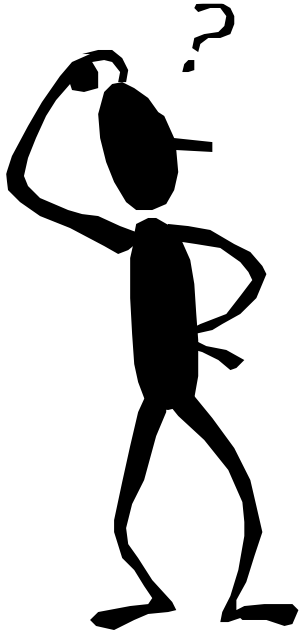


What are corals?



- a. animals?
- b. vegetables?
- c. minerals?

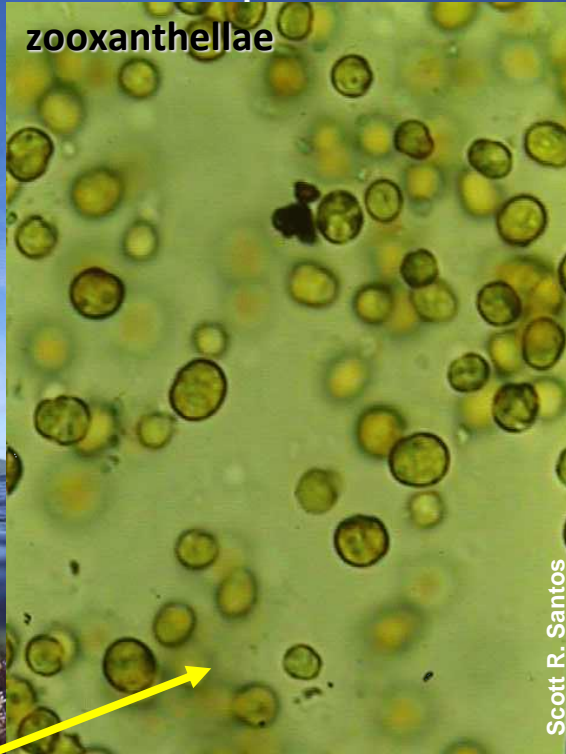
What are corals?



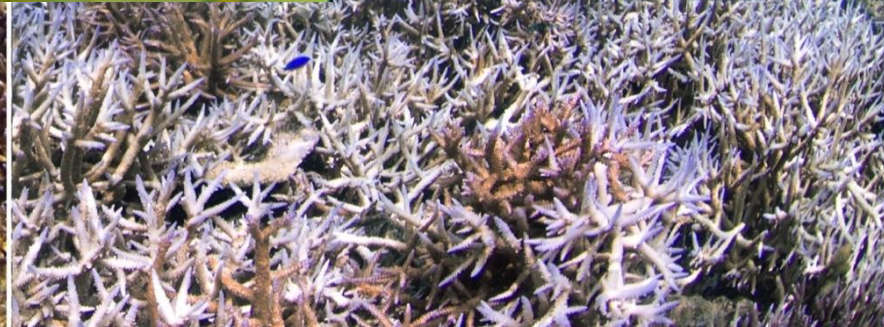
- a. animals?
- b. vegetables?
- c. minerals?
- d. All of the above



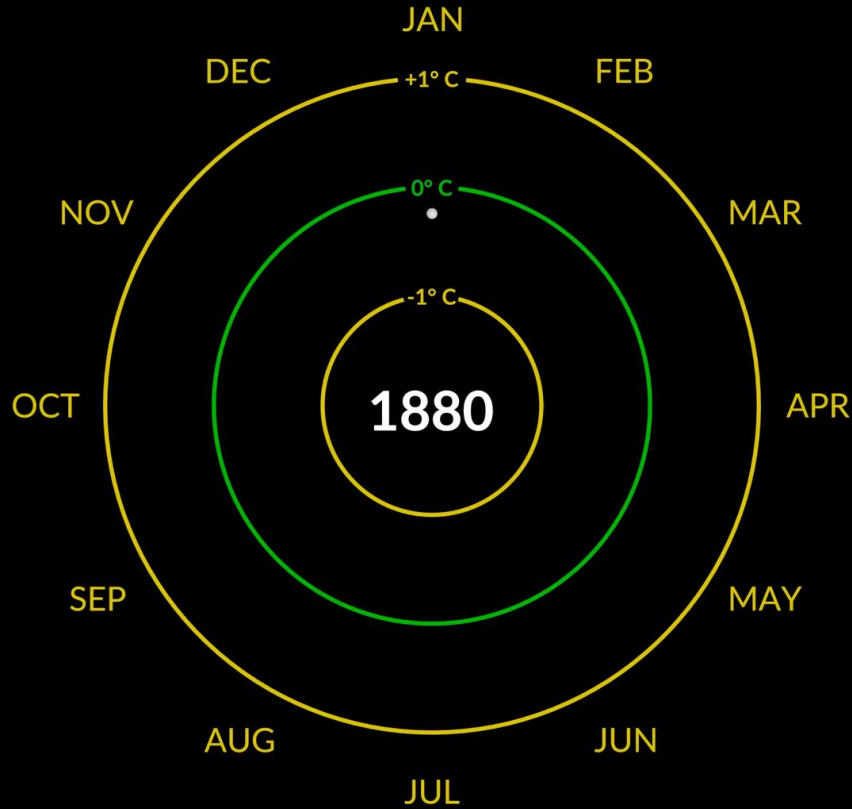
zooxanthellae



Scott R. Santos





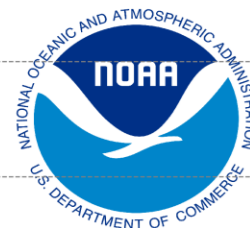
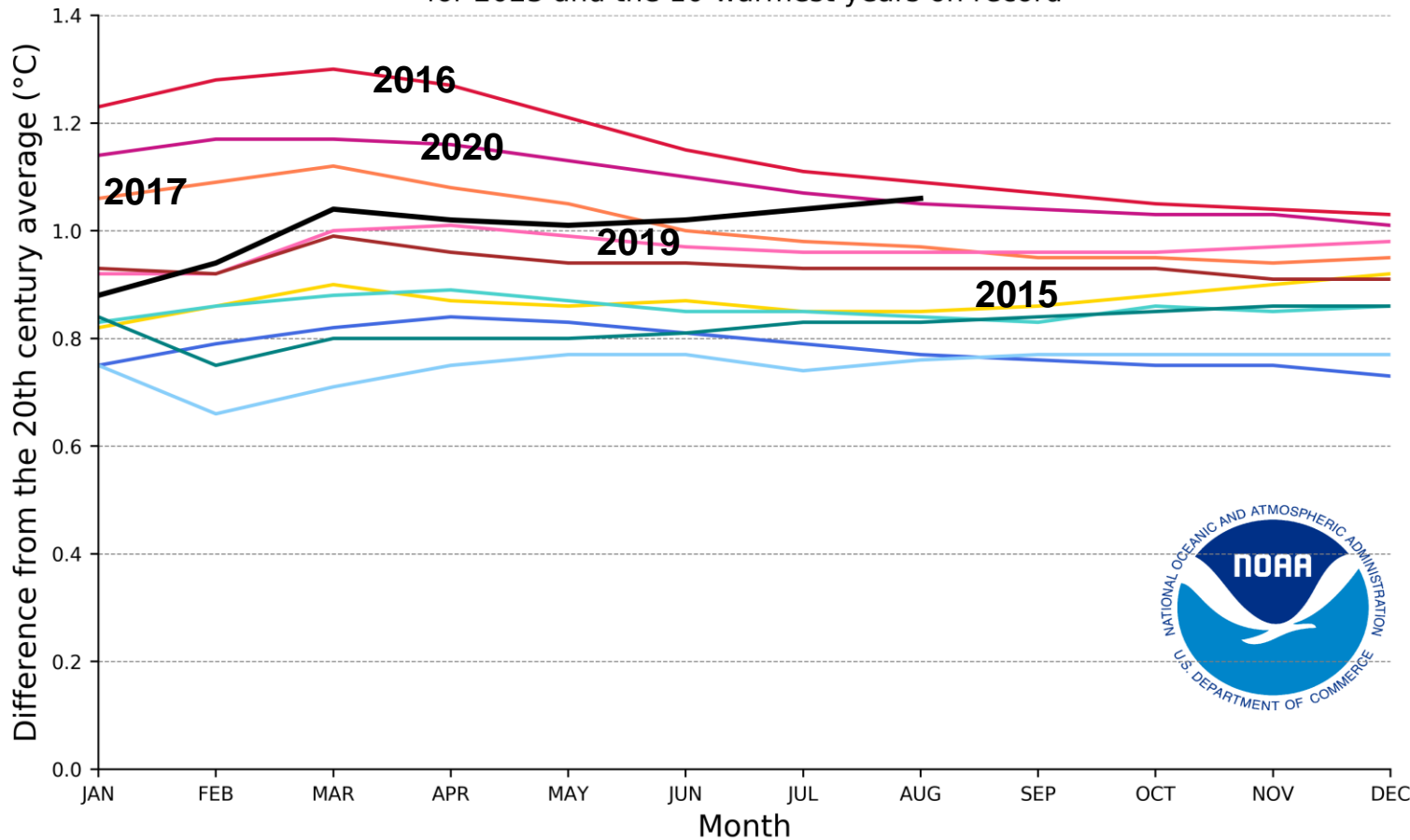


If you are 46 or younger, global temperatures have been warmer than average every year of your life

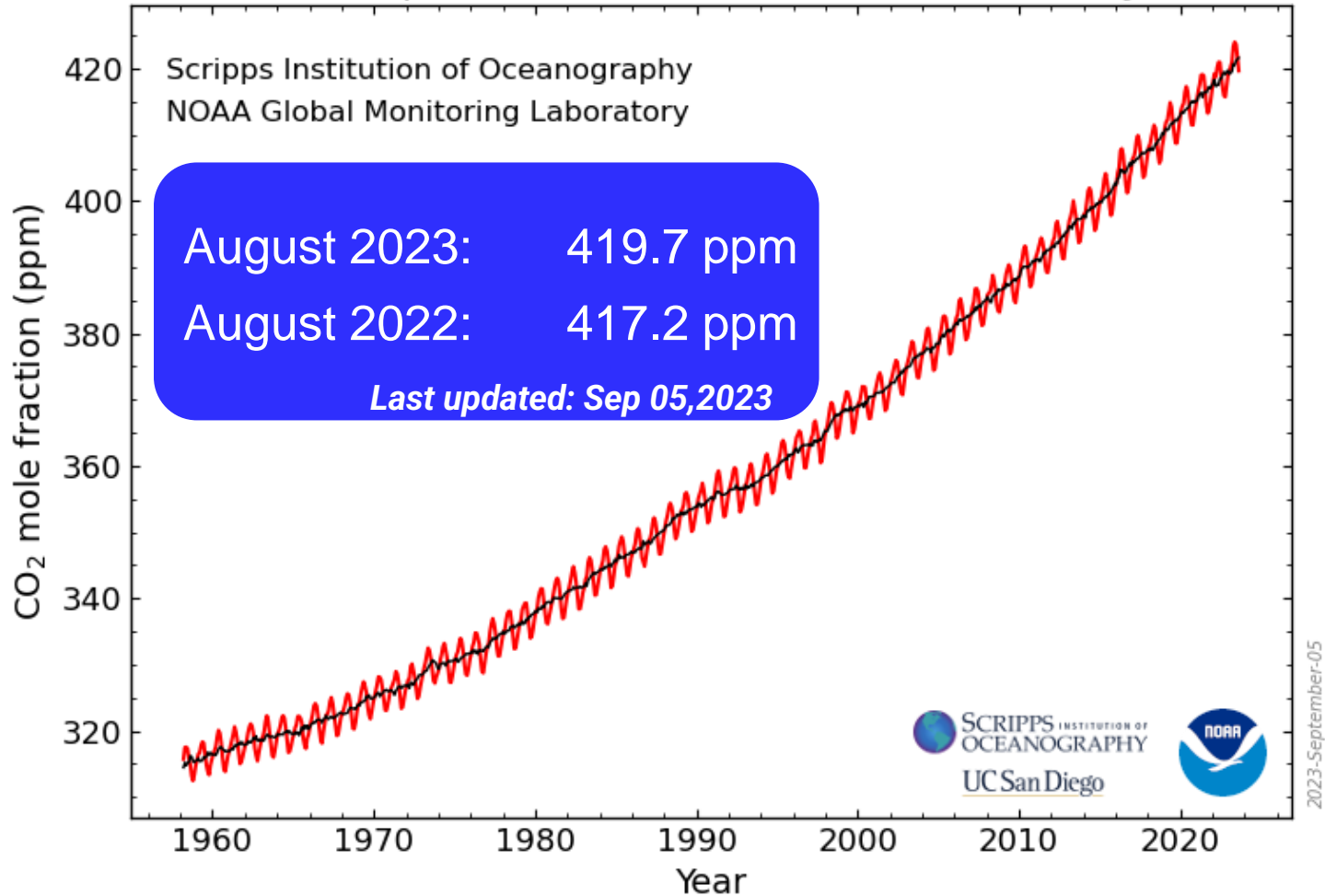
Global Year-to-Date Temperature Anomalies

for 2023 and the 10-warmest years on record

10 Warmest Years on Record

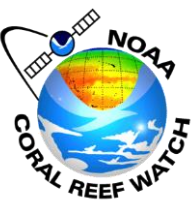


Atmospheric CO₂ at Mauna Loa Observatory

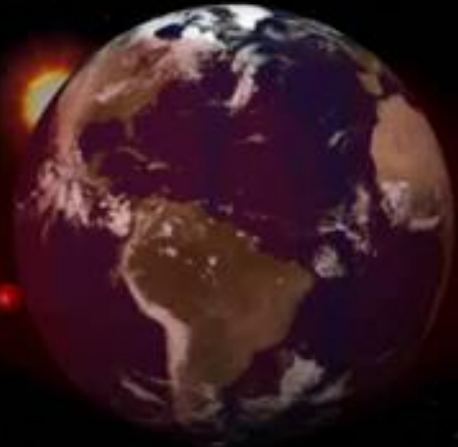


Coral Reef Watch

5-km Satellite-Based Products



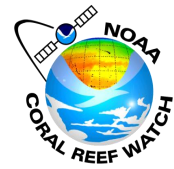
Geostationary Weather Satellite



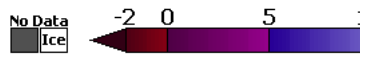
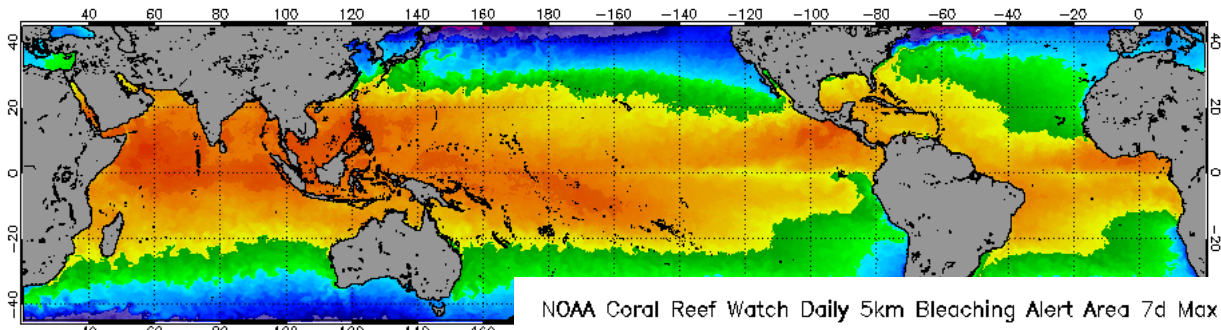
Products use a blend of data from geostationary and polar-orbiting satellite SST



Coral Reef Watch 5 km Satellite-Based Products

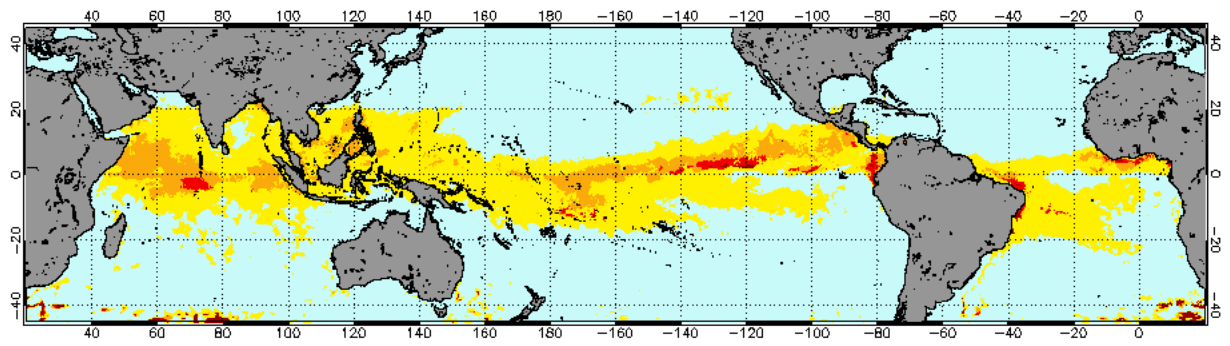


NOAA Coral Reef Watch Daily 5km Sea Surface Temperatures (Version 3.1) 19 May 2019



Sea

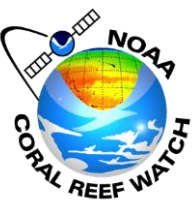
NOAA Coral Reef Watch Daily 5km Bleaching Alert Area 7d Max (Version 3.1) 19 May 2019



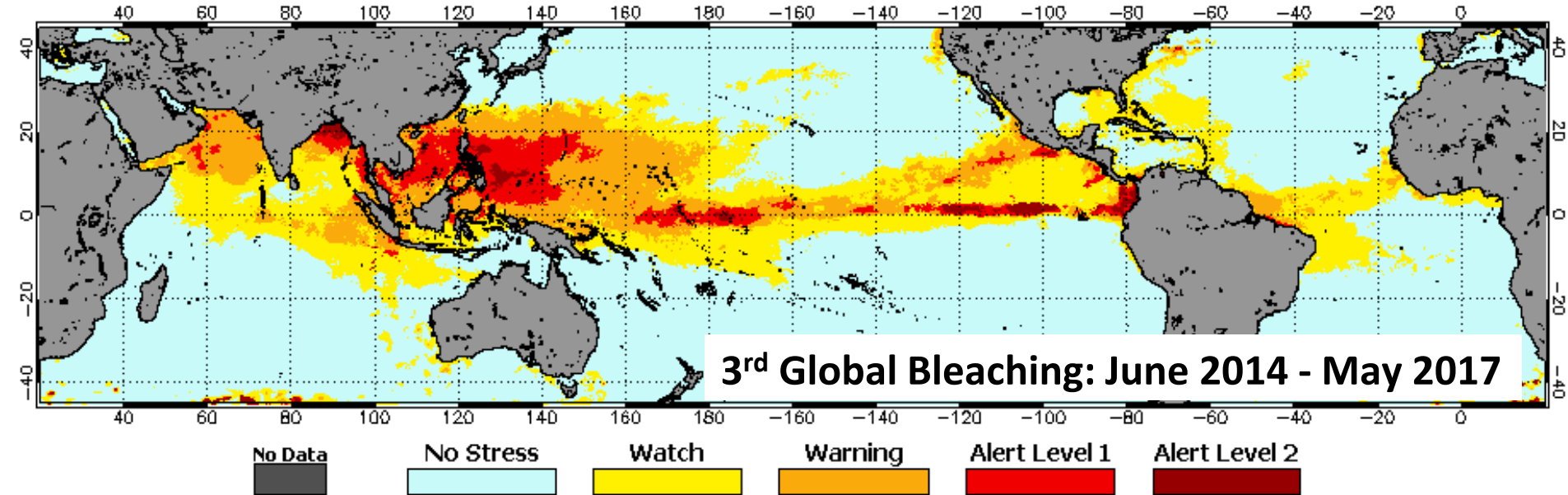
Bleaching Alert Area

<https://coralreefwatch.noaa.gov>

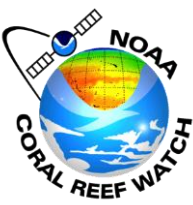
3rd Global Bleaching: June 2014 - May 2017



NOAA CRW 5km Bleaching Alert Area Monthly Maximum (Version 3) Jun 2014

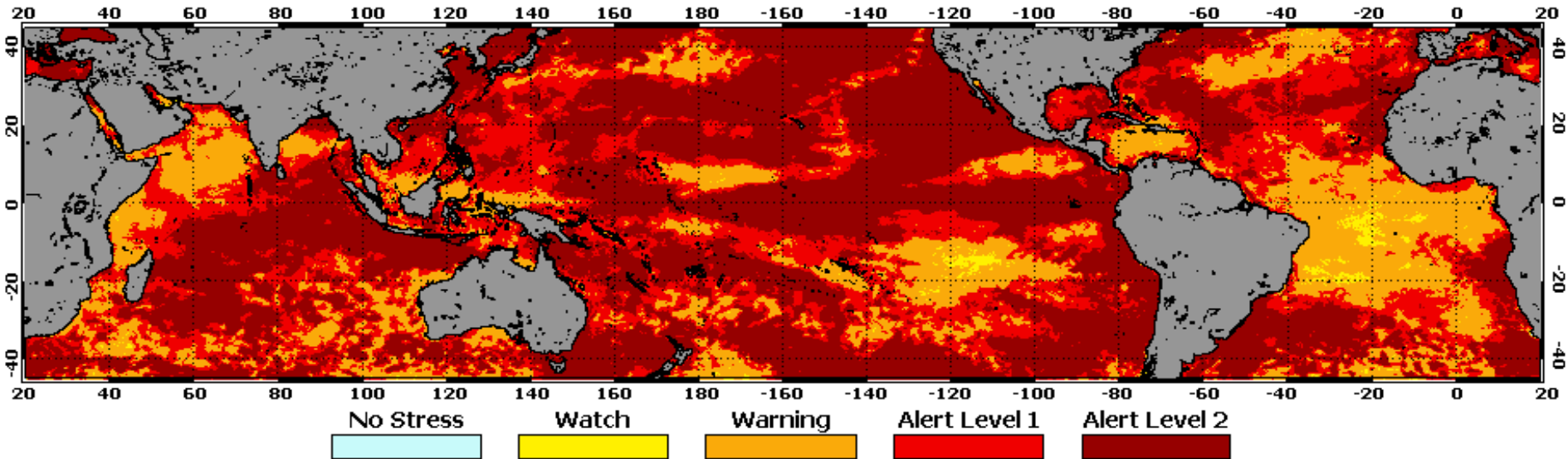


3rd Global Bleaching: June 2014 - May 2017

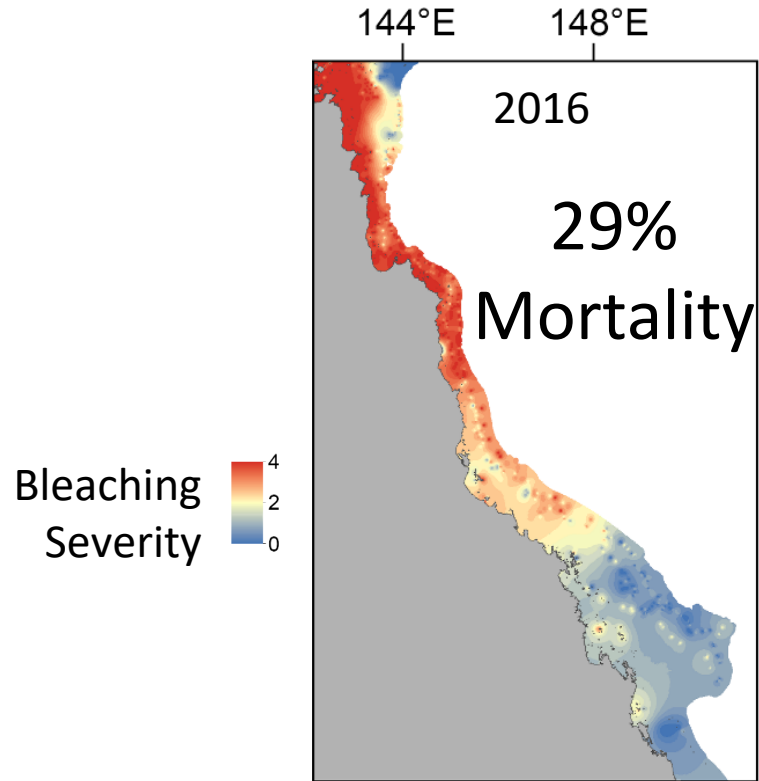


- Longest global bleaching event ever
- Over ½ exposed twice (Guam 4 of 5 years)
- Most widespread and severe reef damage

NOAA Coral Reef Watch 5 km Maximum Satellite Coral Bleaching Alert Area June 2014 - May 2017

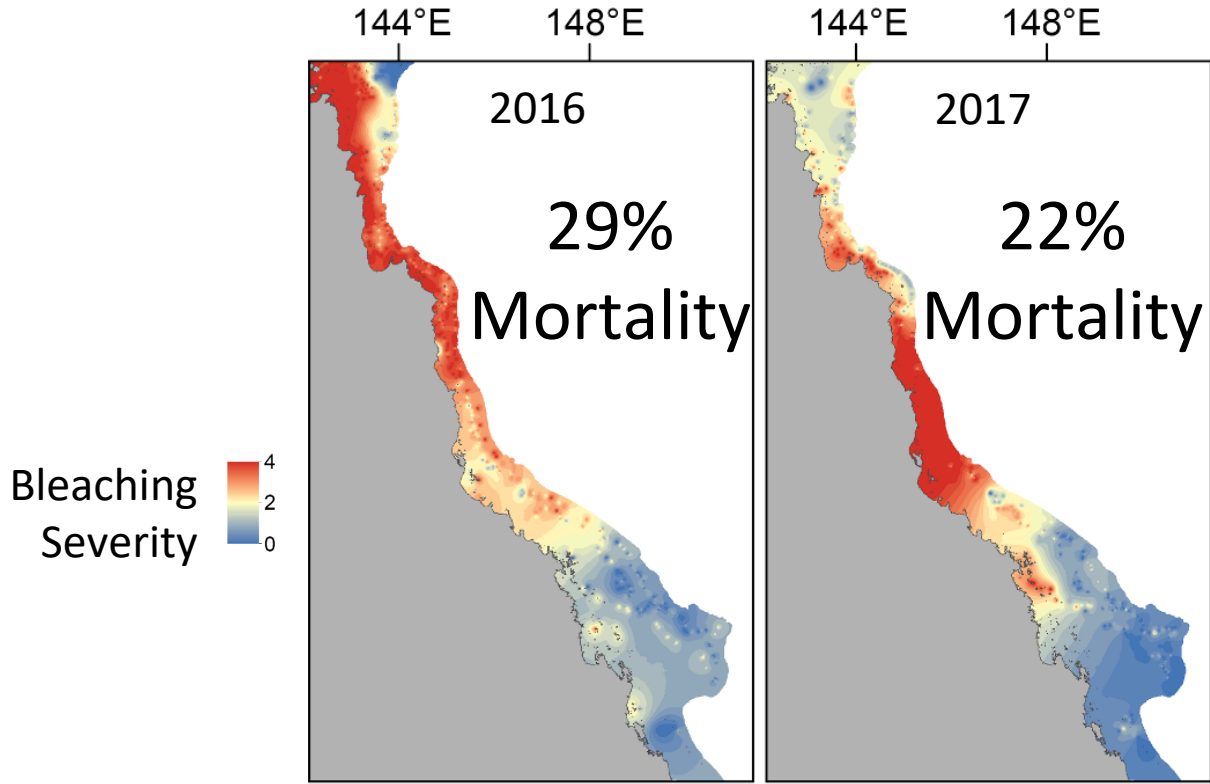


Repeated GBR Bleaching



Hughes et al. 2021. *Current Biology*

Repeated GBR Bleaching



Hughes et al. 2021. *Current Biology*



N FILM

CHASING CORAL

Chasing Coral

2017 | TV-PG | 1h 29m | Documentaries

Divers, scientists and photographers around the world mount an epic underwater campaign to document the disappearance of coral reefs.



Watch all you want.

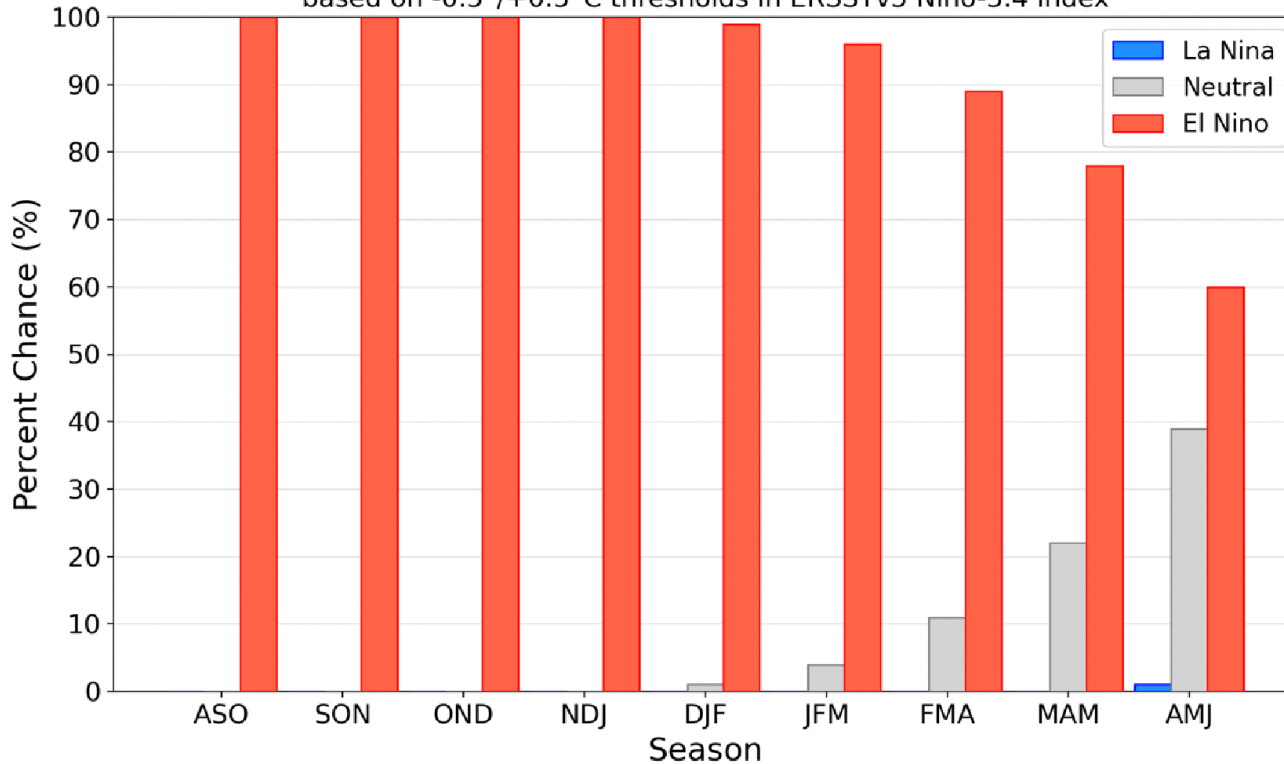
JOIN NOW



Is El Niño Coming Back?

Official NOAA CPC ENSO Probabilities (issued Sep. 2023)

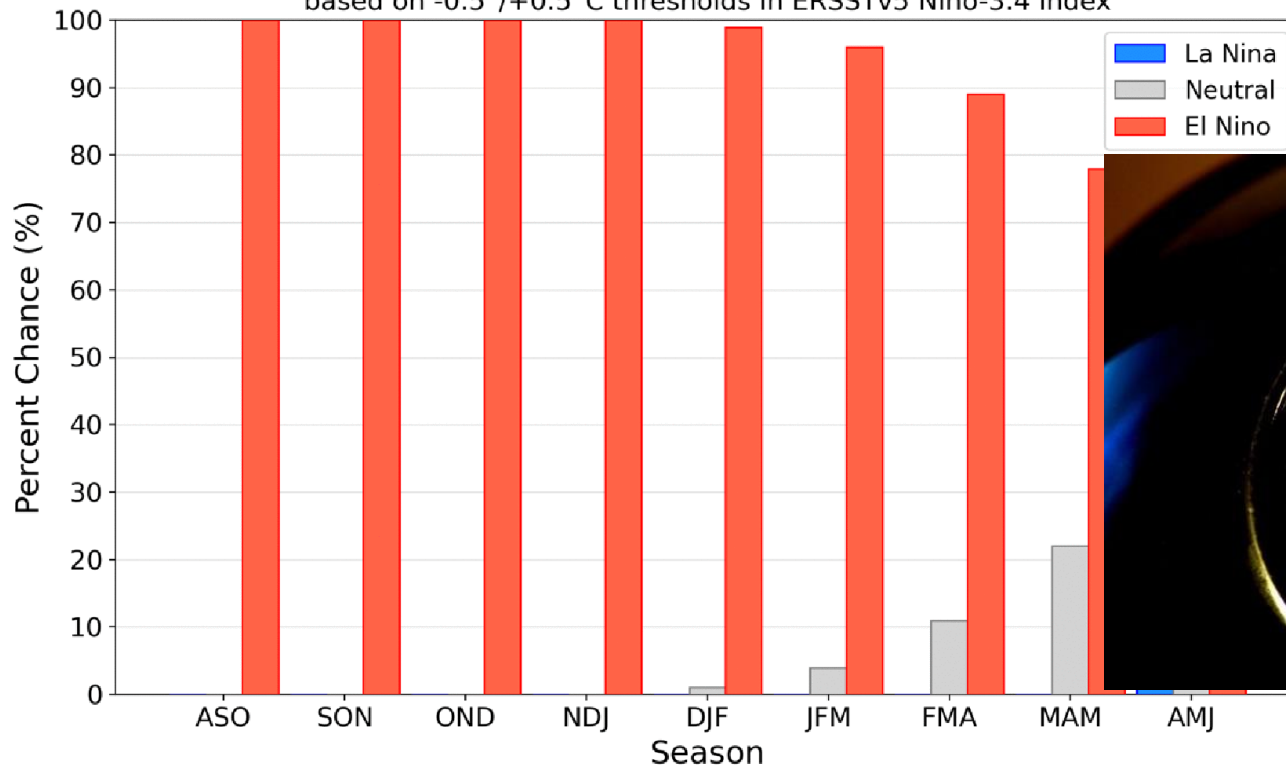
based on $-0.5^{\circ}/+0.5^{\circ}\text{C}$ thresholds in ERSSTv5 Niño-3.4 index



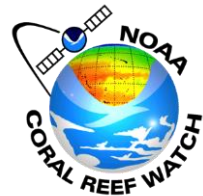
Is El Niño Coming Back?

Official NOAA CPC ENSO Probabilities (issued Sep. 2023)

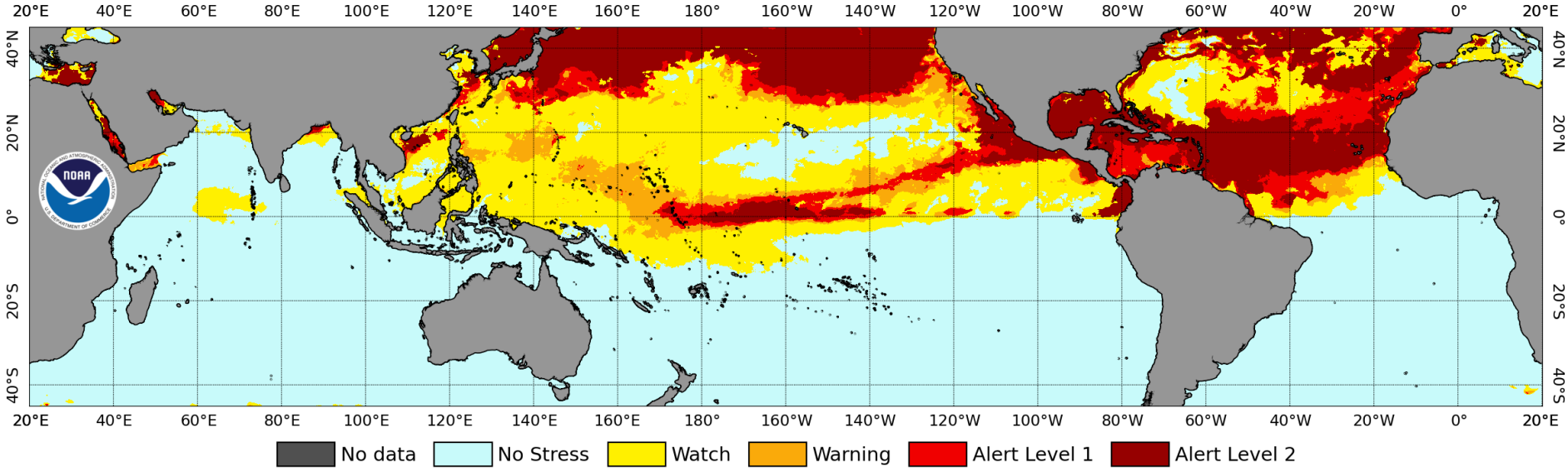
based on $-0.5^{\circ}/+0.5^{\circ}\text{C}$ thresholds in ERSSTv5 Niño-3.4 index



Current Heat Stress



NOAA Coral Reef Watch Daily 5km Bleaching Alert Area 7-day Maximum (v3.1) 19 Sep 2023



Current Heat Stress on Reefs

'Huge' coral bleaching unfolding across the Americas prompts fears of global tragedy

Scientists stunned by unprecedented heat-stress event say they can only hope it 'motivates and unites people'

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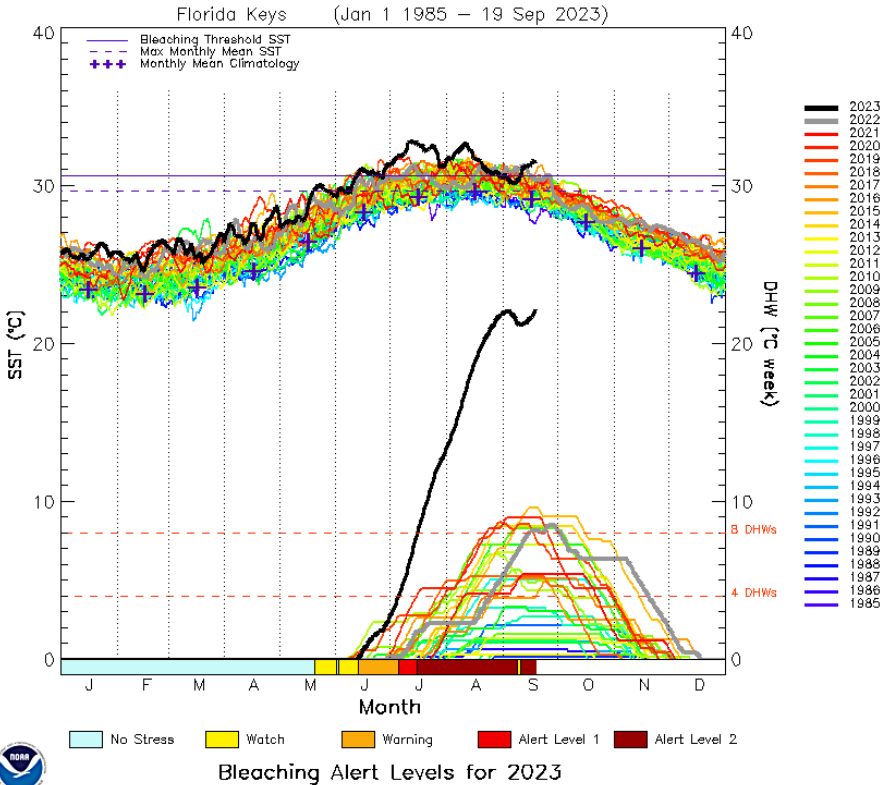
Underwater vision shows 'unprecedented' mass coral bleaching event in the Americas - video

Graham Readfearn

[@readfearn](#)

Fri 11 Aug 2023 01:59 EDT

Current Heat Stress on Reefs



'Huge' coral bleaching unfolding across the Americas prompts fears of global tragedy

Scientists stunned by unprecedented heat-stress event say they can only hope it 'motivates and unites people'

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Underwater vision shows 'unprecedented' mass coral bleaching event in the Americas - video

Graham Readfearn

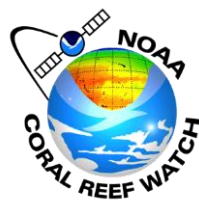
@readfearn

Fri 11 Aug 2023 01:59 EDT

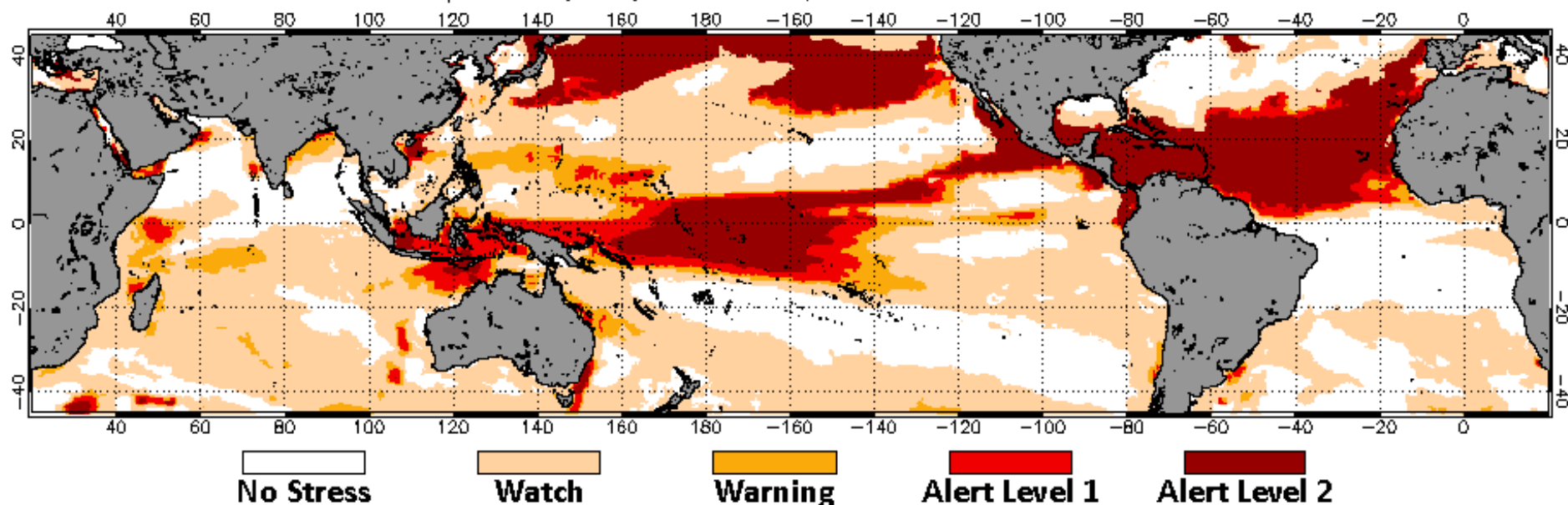


Forecasting Bleaching

Oct 2023 – Jan 2024

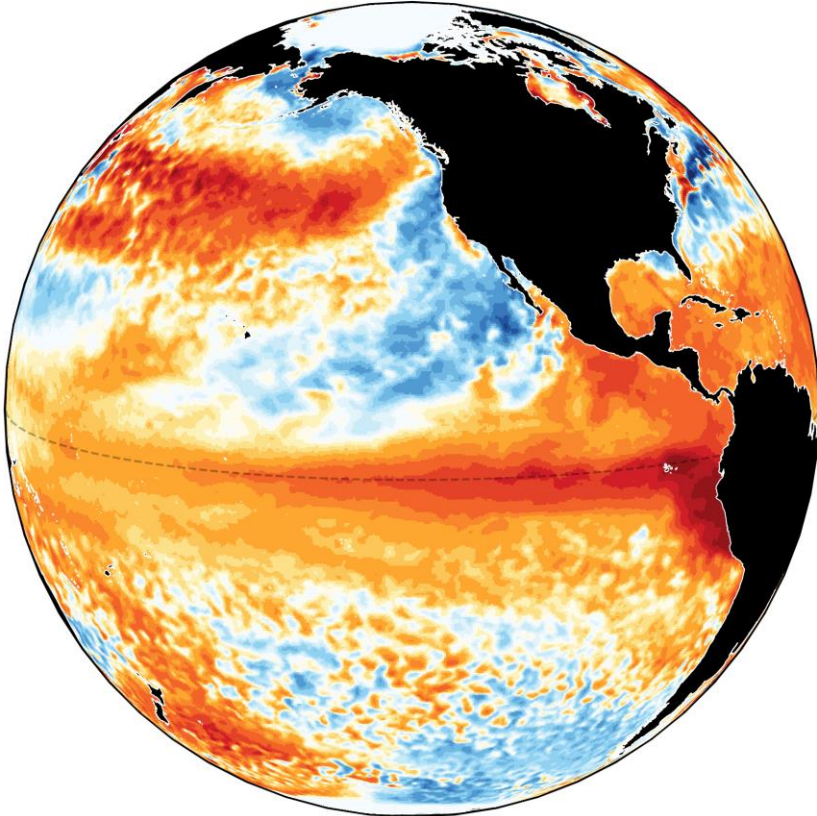


2023 Sep 19 NOAA Coral Reef Watch 60% Probability Coral Bleaching Heat Stress for Oct–Jan 2024
Experimental, v5.0, CFSv2-based, 28 to 112 Ensemble Members

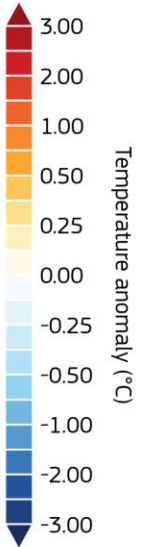
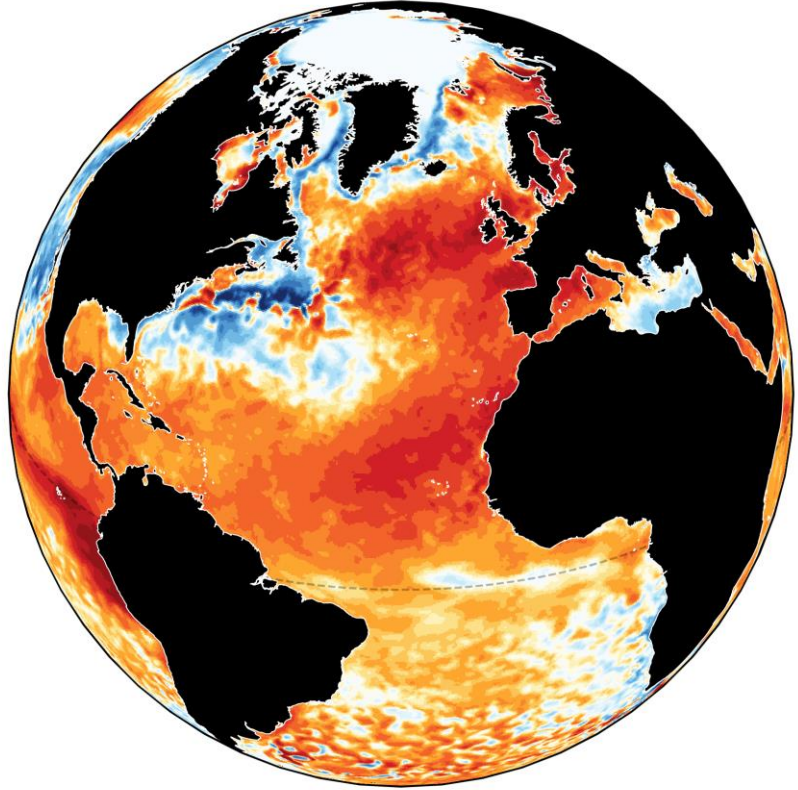


Not Just Coral Reefs

SEA SURFACE TEMPERATURE ANOMALY • JUNE 2023
relative to June average for 1991–2020



SEA SURFACE TEMPERATURE ANOMALY • JUNE 2023
relative to June average for 1991–2020

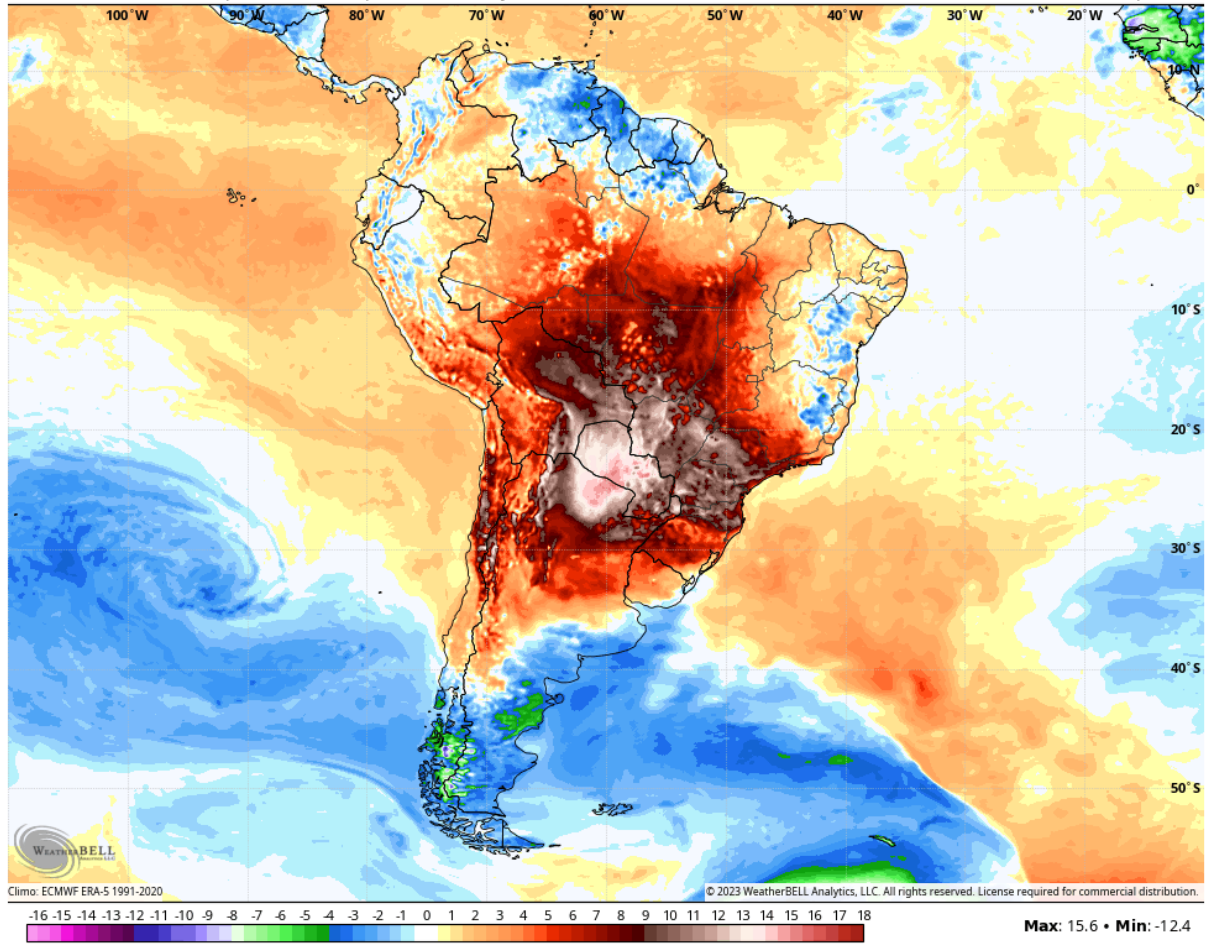


Data: ERA5
Credit: C3S/ECMWF



Not Just Coral Reefs

GFS 0.12° Init 12z 20 Sep 2023 • 2m Temperature Anomaly (°C) Hour: 48 • Valid: 12z Fri 22 Sep 2023

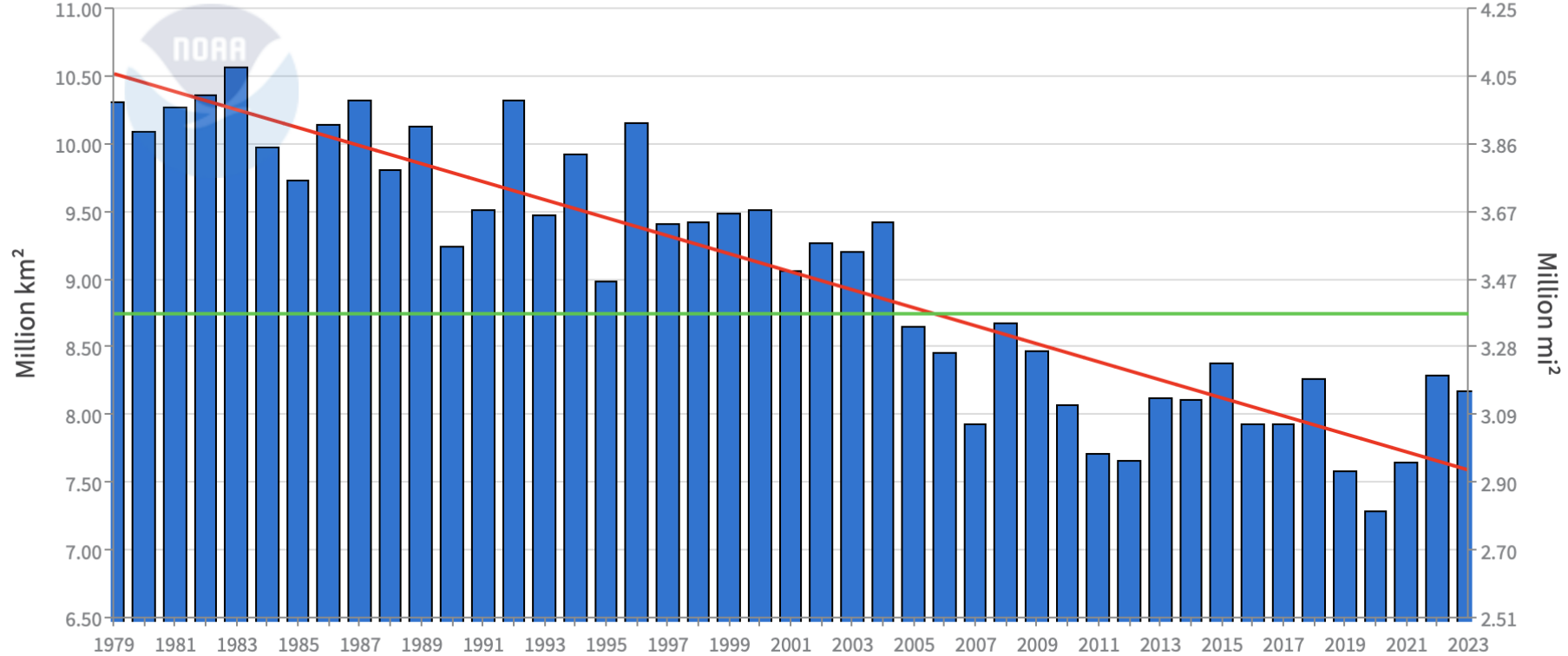


Not Just Coral Reefs

Northern Hemisphere Sea Ice

July, 1979-2023

Decadal Trend: -7.43%
-0.65 million km²



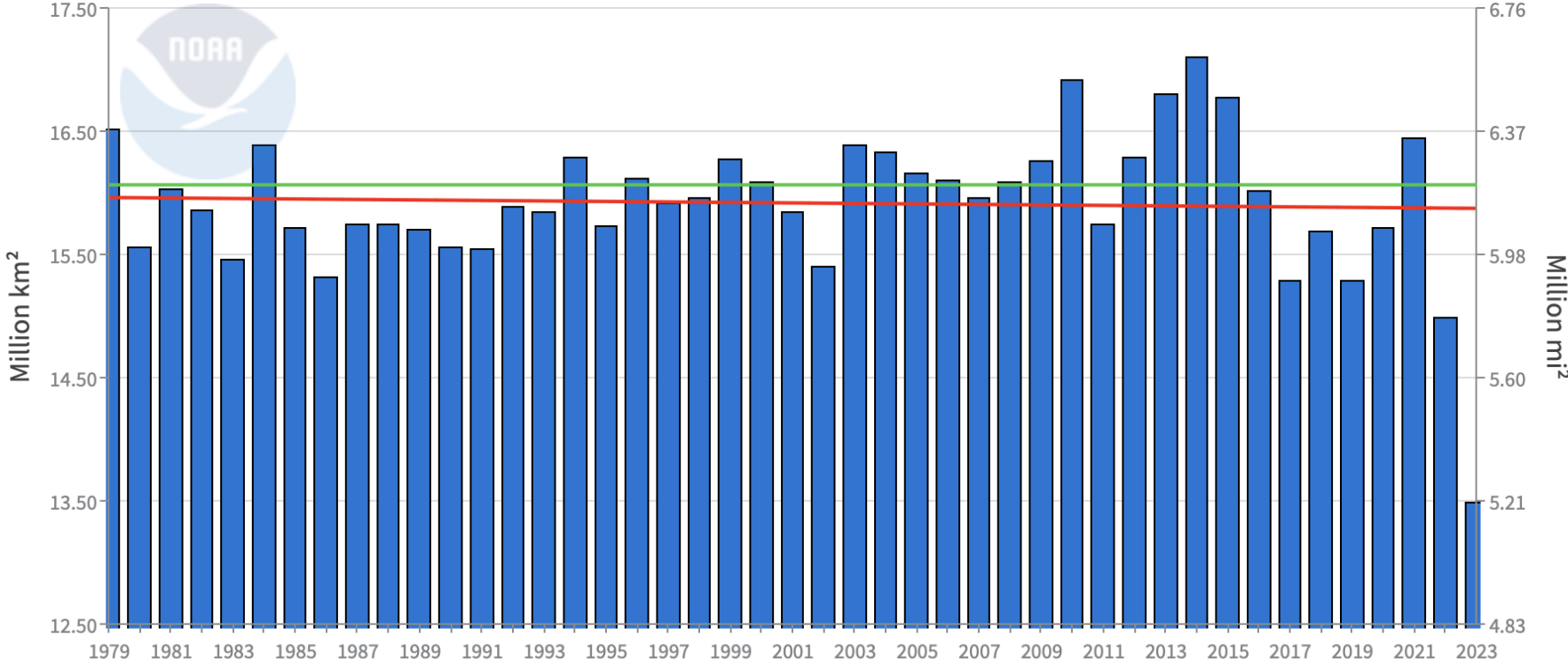
1991-2020 Average: 8.75 million km² (3.38 million mi²)

Not Just Coral Reefs

Southern Hemisphere Sea Ice

July, 1979-2023

Decadal Trend: -0.12%
-0.02 million km²



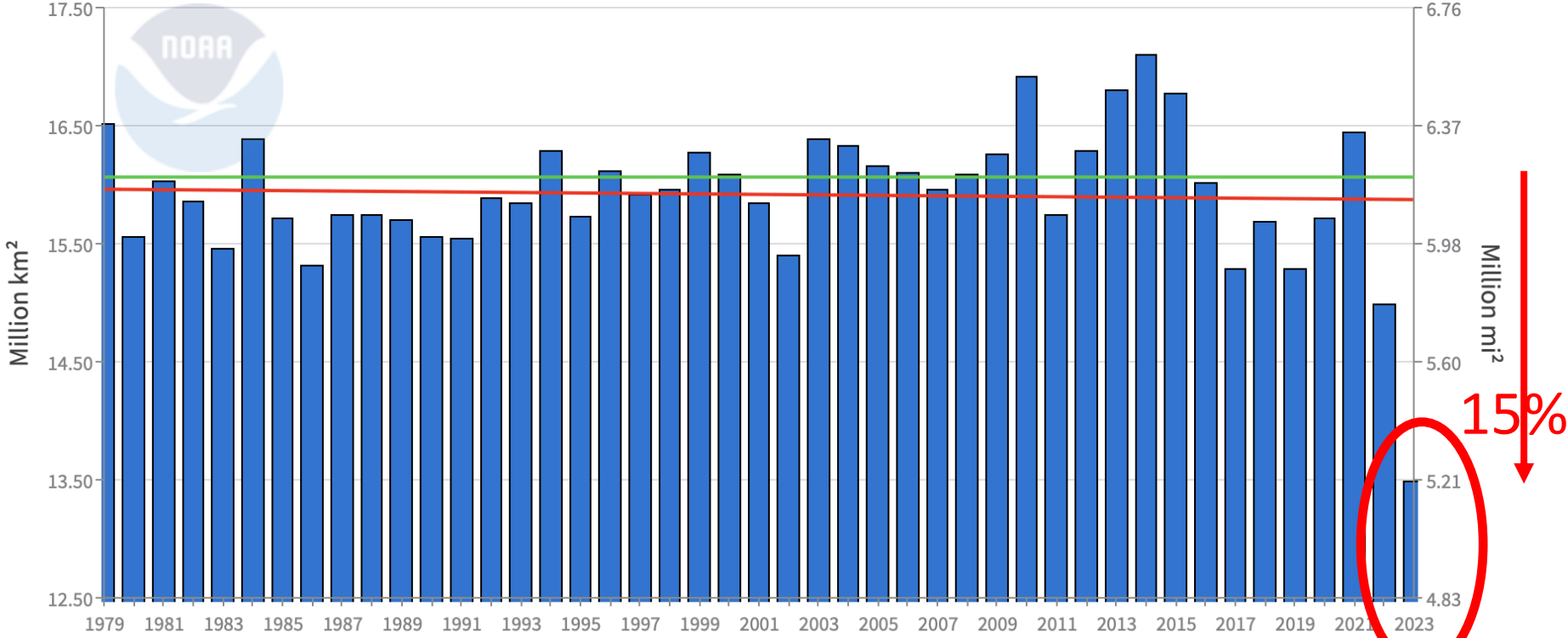
1991-2020 Average: 16.07 million km² (6.20 million mi²)

Not Just Coral Reefs

Southern Hemisphere Sea Ice

July, 1979-2023

Decadal Trend: -0.12%
-0.02 million km²

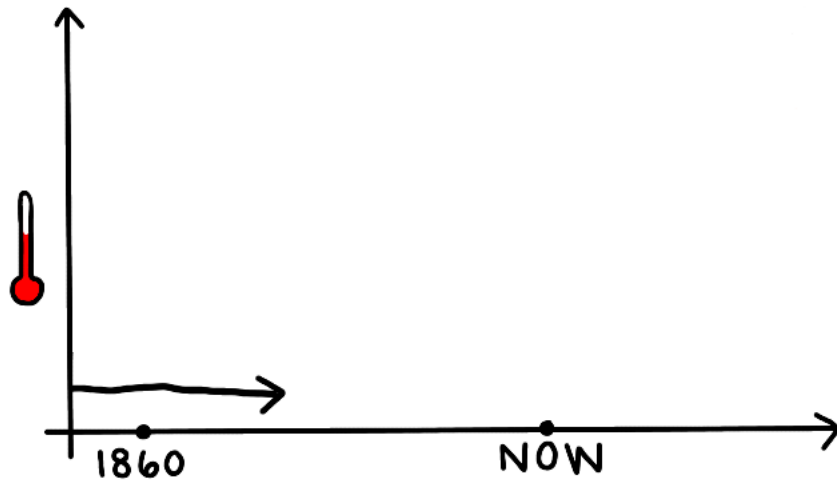


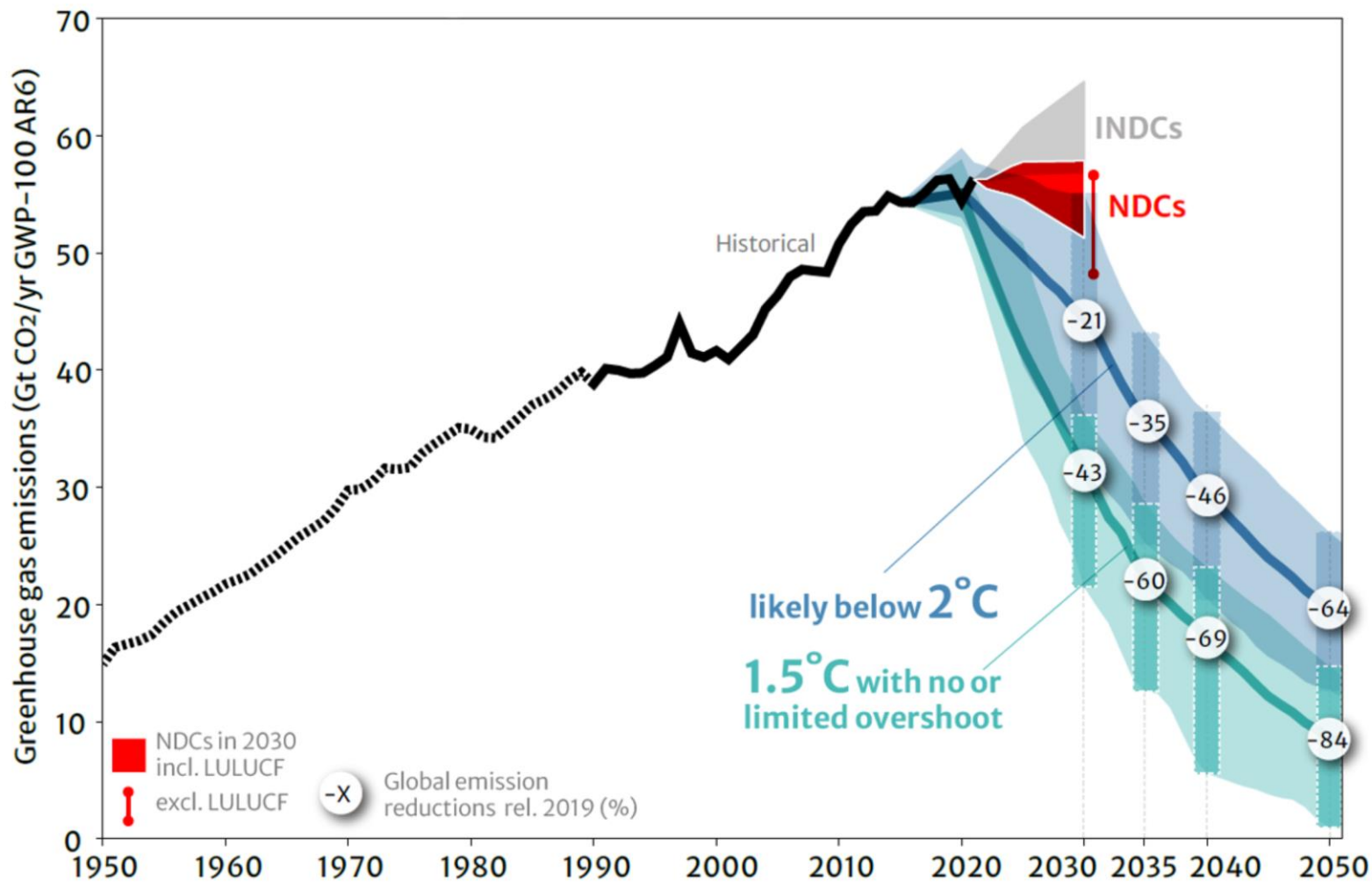
1991-2020 Average: 16.07 million km² (6.20 million mi²)

15%

1°C

1°C





1. National and Global Action to Reduce CO₂

Futurism

NEWS

FEATURES

VIDEOS



Earth & Energy

France Is Officially Shutting All Coal-Fired Power Plants in Three Years

Creative Commons

2. Individual Actions to Reduce CO₂

Jan. 26, 2018, 1:01 p.m.

STATE GOVERNMENT



By LIAM DILLON

California will put 5 million electric cars on the road by 2030, Gov. Jerry Brown says



2. Individual Actions to Reduce CO₂



Jim Farley @jimfarley98 · Jun 15

By the year 2030, we expect 40% of our global vehicle volume to be fully electric. To get there, we have increased our investment in electrification to \$30B by 2025.



27 43 313 [Share icon]

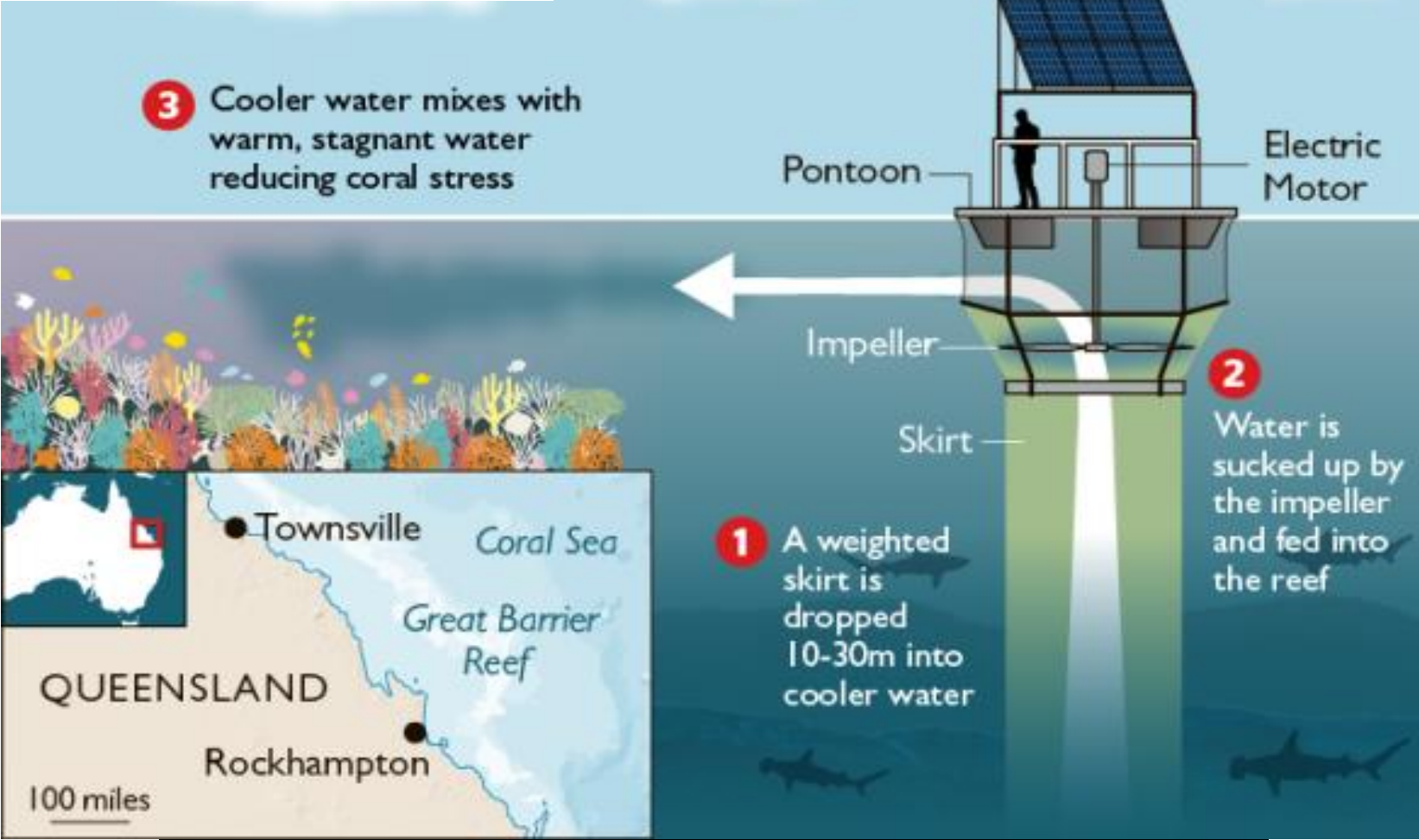


3. Reduce Global CO₂ through Carbon Capture and Storage

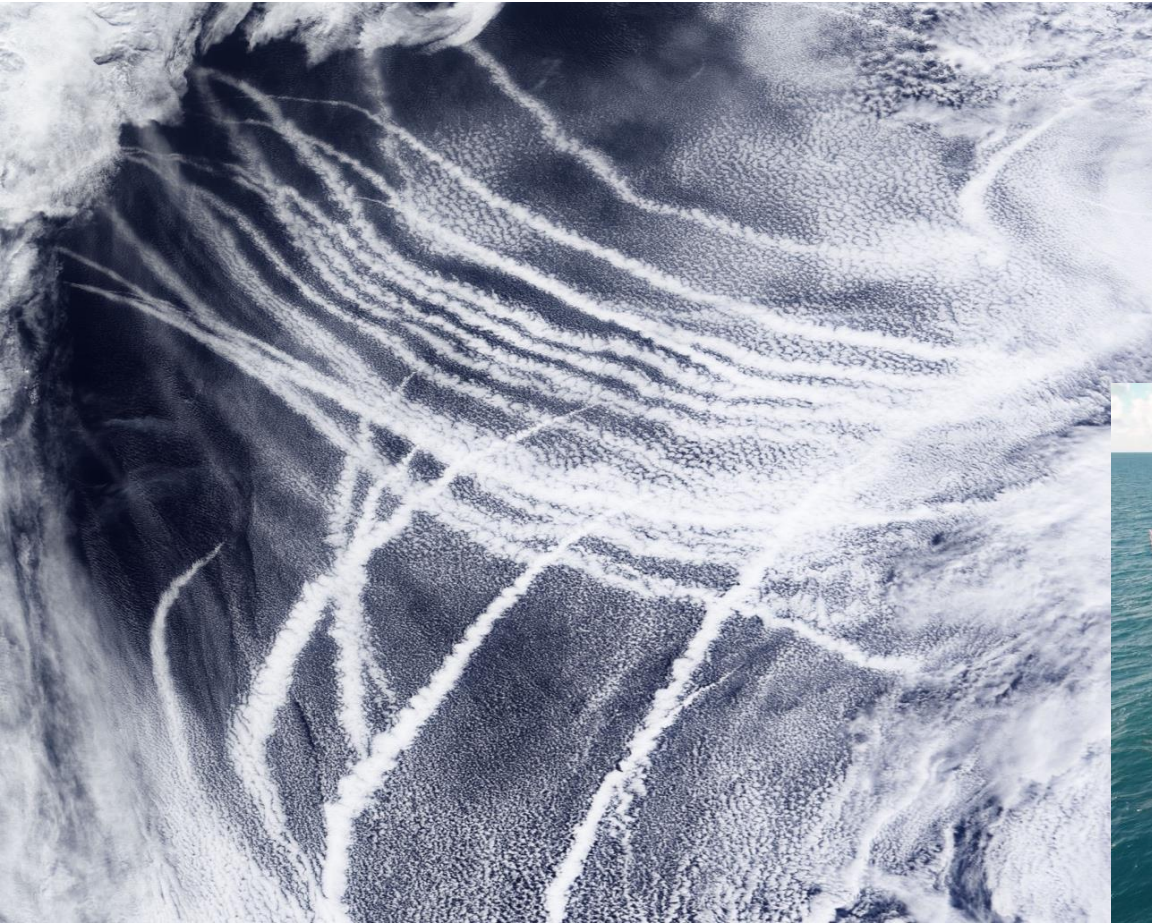


Artist depiction

4. Local-Scale Interventions



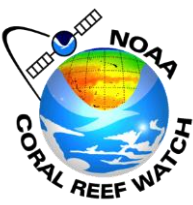
5. Large-Scale Interventions



6. Reduce Local Stressors



7. Work Locally to Help Reefs Recover

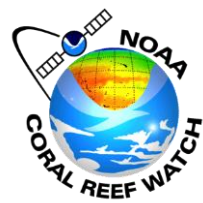


Coral Restoration:



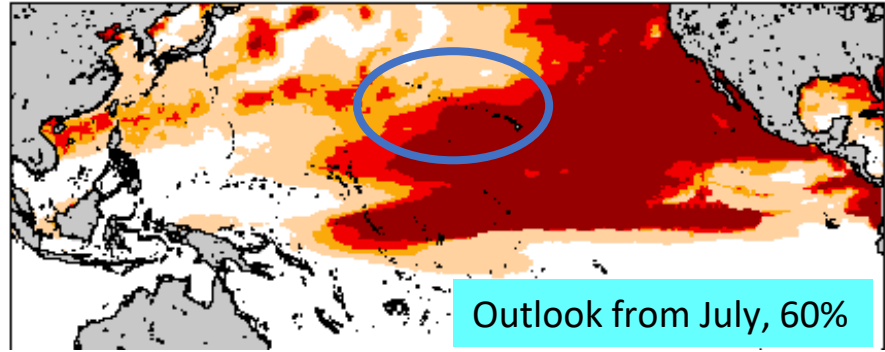
NOAA
CORAL REEF
CONSERVATION PROGRAM





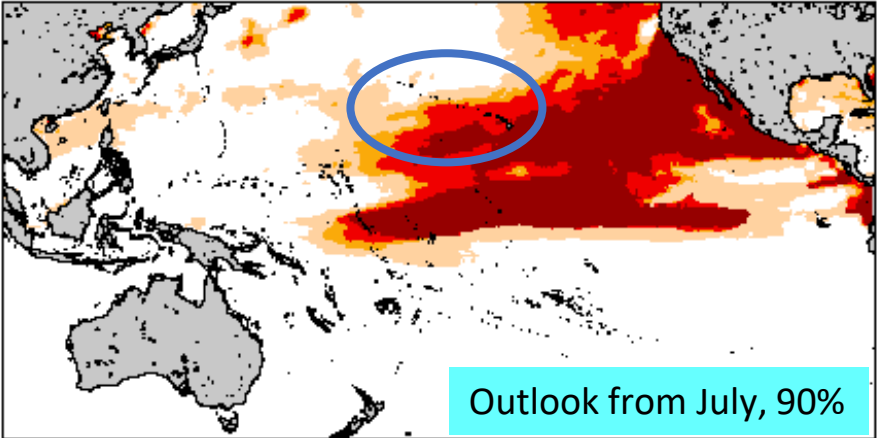
2015 Four-Month Bleaching Outlook: Hawai'i

2015 Jun 30 NOAA 60% Probability Bleaching Thermal Stress for Jul–Oct 2015
Experimental, v3.0, CFSv2–based, 28–member

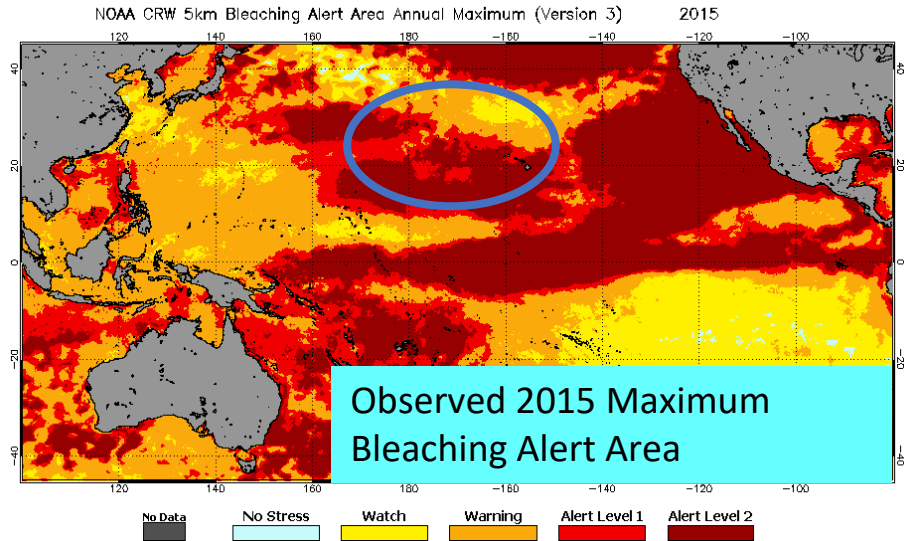


Outlook from July, 60%

2015 Jun 30 NOAA 90% Probability Bleaching Thermal Stress for Jul–Oct 2015
Experimental, v3.0, CFSv2–based, 28–member



Outlook from July, 90%



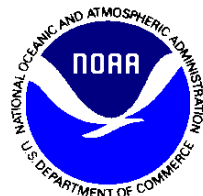
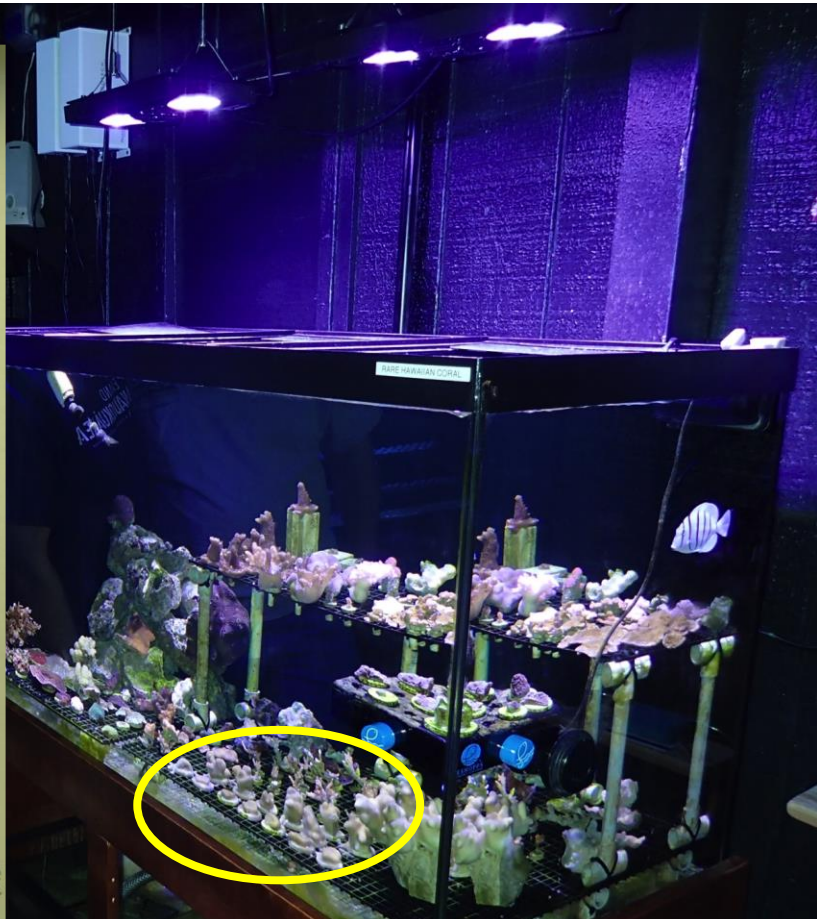
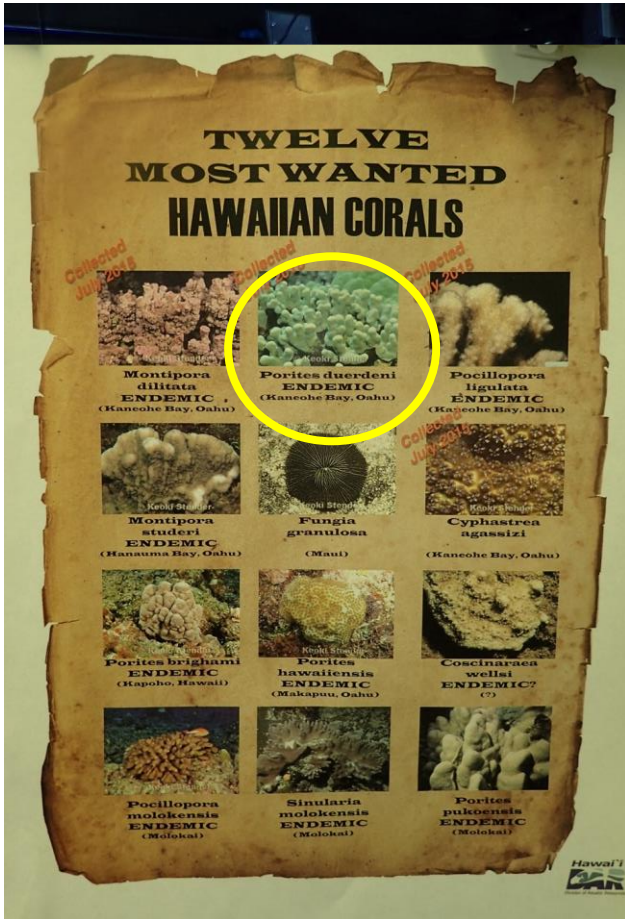
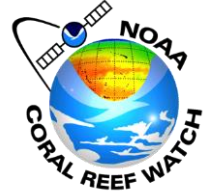
Observed 2015 Maximum Bleaching Alert Area

Potential Stress Level: Watch Warning Alert Level 1 Alert Level 2



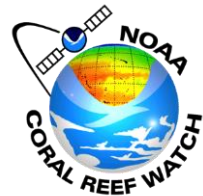
Addressing Bleaching Locally

2015 Hawai'i Bleaching – DAR “Ark”



Addressing Bleaching Locally

2015 Hawai'i Bleaching – DAR “Ark”



HOME NEWS WEATHER SPORTS

Coral 'planting' event coincides with World Oceans Day

The two-day event is called Coralpalooza.

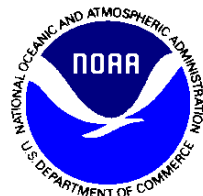
Saturday, June 8th 2019, 4:12 PM HST



TWELVE MOST WANTED HAWAIIAN CORALS

<p>Collected July 2011</p> <p>Montipora dilatata ENDEMIC (Kaneohe Bay, Oahu)</p>	<p>Collected July 2011</p> <p>Porites duerdeni ENDEMIC (Kaneohe Bay, Oahu)</p>	<p>Collected July 2011</p> <p>Pocillopora ligulata ENDEMIC (Kaneohe Bay, Oahu)</p>
<p>Collected July 2011</p> <p>Montipora studeri ENDEMIC (Hanalei Bay, Oahu)</p>	<p>Collected July 2011</p> <p>Fungia granulosa (Maui)</p>	<p>Collected July 2011</p> <p>Cyphastrea agassizi (Kaneohe Bay, Oahu)</p>
<p>Collected July 2011</p> <p>Porites brighami ENDEMIC (Kapoho, Hawaii)</p>	<p>Collected July 2011</p> <p>Porites hawaiiensis ENDEMIC (Makapuu, Oahu)</p>	<p>Collected July 2011</p> <p>Coscinaraea wellsi ENDEMIC (?)</p>
<p>Collected July 2011</p> <p>Pocillopora molokensis ENDEMIC (Molokai)</p>	<p>Collected July 2011</p> <p>Sinularia molokensis ENDEMIC (Molokai)</p>	<p>Collected July 2011</p> <p>Porites pukoensis ENDEMIC (Molokai)</p>

Hawai'i
CORAL REEF
CONSERVATION PROGRAM



Chasing Coral

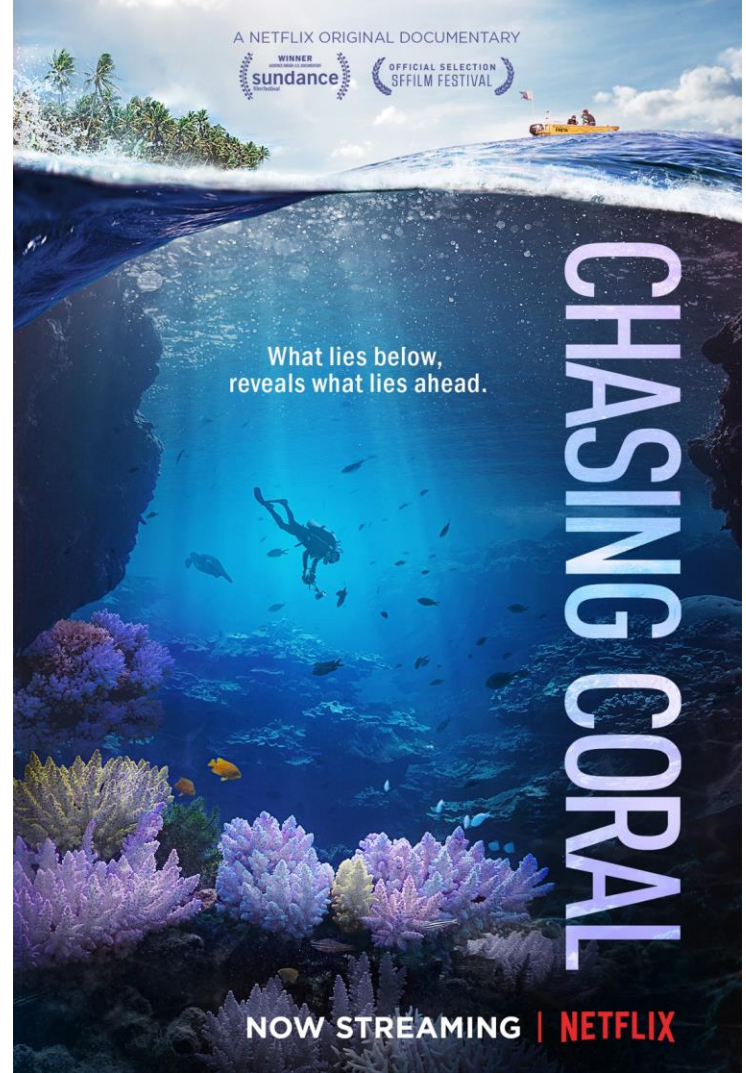
- 2017 Sundance Audience Award for Best US Documentary
- 2018 Emmy for Best Nature Documentary
- Streaming on Netflix
- Free on Netflix YouTube channel



 Chasing Coral

 @ChasingCoral

[ChasingCoral.com](https://www.ChasingCoral.com)



“... the answer is not greater and greater attention to more and more crises. It is more time spent by each of us on the nurture of joy and the cultivation of **hope**. Which is, as the poet Emily Dickinson teaches us, “the thing with feathers.””

-- David Von Drehle
Washington Post

<https://www.washingtonpost.com/opinions/2023/03/31/how-to-solve-crises/>



Thank you

Beyond *Chasing Coral*:
Bleaching Continues But
You Can Make a Difference

Dr. C. Mark Eakin

